JPRS 79819

8 January 1982

East Europe Report

SCIENTIFIC AFFAIRS

No. 727

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CONTENTS

CZECHOSLOVAKIA

SMEP MINICOMPUTER SYSTEM DESCRIBED

Prague VYBER INFORMACI Z ORGANICNI A VYPOCETNI TECHNIKY in Czech No 3, 1981 pp 275-282

[Article by Eng Ivan Peceny, Kancelarske Stroje [Office Machines] special concern: "Making SMEP Minicomputers Available to Czechoslovak Users"]

[Text] As in the case of the classical "large" general-purpose computers (i.e. the JSEP [Unified Series of Electronic Computers]), the research, production and applications efforts of the CEMA countries in the minicomputer field have also been integrated by the Intergovernmental Commission on Data-Processing Equipment. In 1976, the SMEP (System of Small Electronic Computers) program, managed by the SMEP Council of Chief Designers (RHK), was created. RHK SMEP has several groups of specialists and temporary working groups to deal with specific problems involving the development, design, production and supplying of SMEP minicomputers.

The SMEP system is a combination of hardware and software systems, a system of standard-setting, procedural and operational guidelines, and a system of standards. In addition, this combination is supported by a reasonable degree of compatibility and standardization of the system, architecture and design approaches. The SMEP is intended for the creation of control-computer systems, which are used principally in systems for controlling manufacturing processes and units, systems for automating scientific research, automated design systems, and control systems for nonindustrial areas, as well as for commercial and engineering calculations which do not require large capacity. The SMEP is based on the cooperation and common effort of Bulgaria, Hungary, East Germany, Cuba, Poland, Romania, the Soviet Union and Czechoslovakia.

The principal areas of application of the SMEP include:

--automated control systems (ASR) for both constantly-operating continuous and constantly-operating discrete manufacturing processes and production units;

--ASR's for manufacturing procedures and systems for running control of noncontinuous production processes;

--systems for automating scientific experiments.

The SMEP project consists of two sequential stages, SMEP I and SMEP II. Currently, the beginning of series production and delivery is culminating the integration efforts of the SMEP I stage.

SMEP I includes the following groups of equipment:

--a basic series of four processors with different degrees of productivity (SM-1P, SM-2P, SM-3P and SM-4P);

--several types of external storage units, used to record data on magnetic tape or disks;

--an extensive selection of input-output units, including printers of various capacities, keyboards and punched-tape and card-processing equipment;

--displays, including alphanumeric and graphic types;

--units for interfacing with the environment or with the controlled process;

--equipment for telecommunications and intracomputer and intercomputer communications.

The SMEP system is designed as a uniform modular system making it possible to create control-computer systems with a variety of hardware configurations and to replace system components with others performing similar functions without changing the overall system function.

The SMEP software is based on the modular principle. This makes it possible to generate programs which provide the required operating modes and intended system functions in specific hardware configurations. SMEP software includes operating systems for various purposes, libraries, sets of system-oriented or problem-oriented applications programs, and sets of auxiliary, test and diagnostic programs.

The SMEP is designed as an open system. This implies the possibility of adding to and expanding both software and hardware. There are various ways of expanding the system:

--introducing newly developed general-purpose or special peripherals;

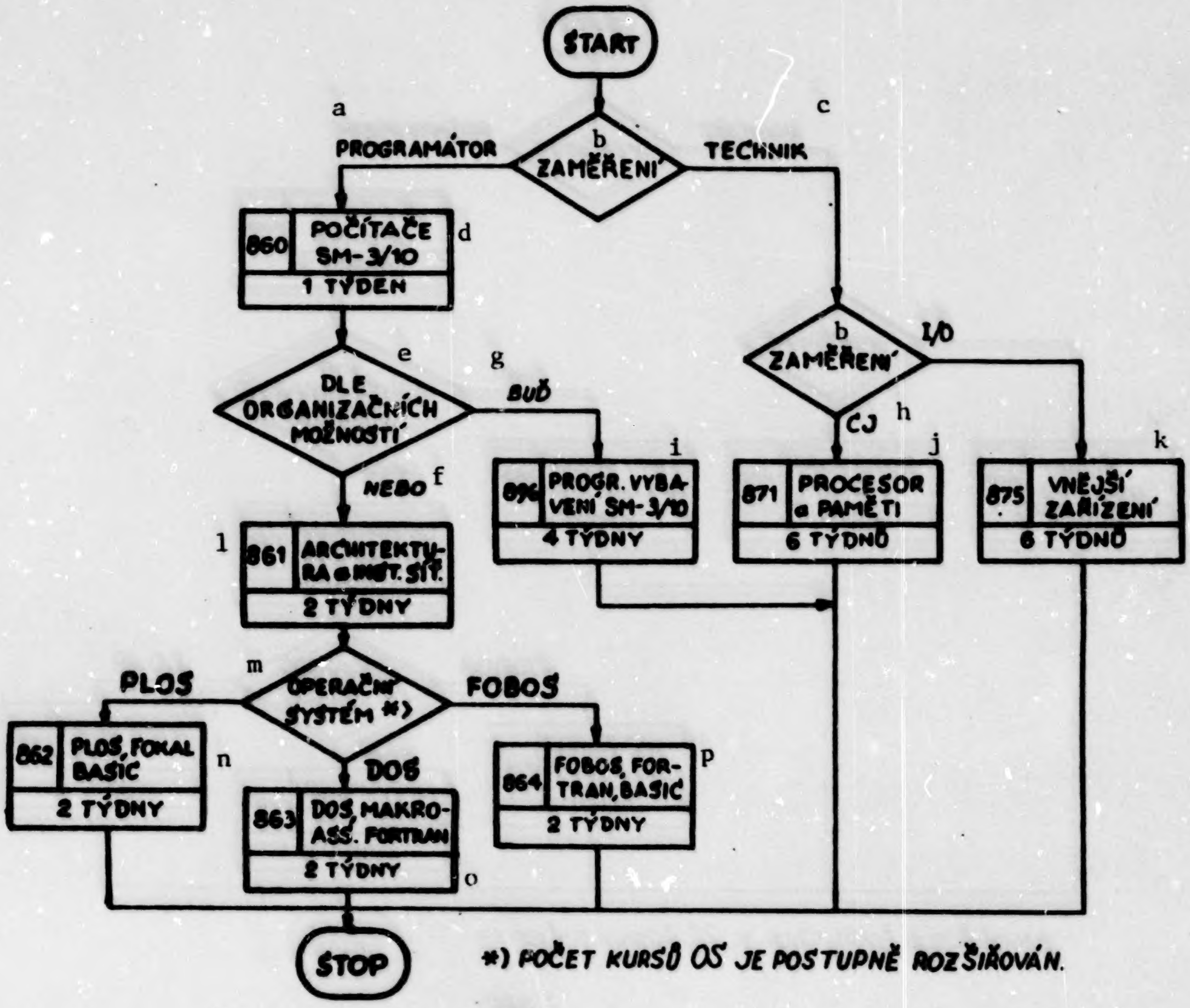
--introducing a wide variety of data-processing methods into SMEP software so as to expand the range of system applications.

The SMEP series is to be expanded both within the SMEP I stage and by the creation of SMEP II hardware and software.

Among the SMEP I computers we distinguish two branches, which differ from each other in their instruction sets, processors, method of connection of peripherals, interrupt organization and the like. The main differences between the processors thus are in the areas which determine the so-called "architecture" of the control-computer system, an aspect which depends on the particular processor.

One of the branches includes the SM-1 and SM-3 minicomputers, which are modeled after the Hewlett-Packard HP-21 minicomputer. Computers in this group are compatible with the Soviet M-6000 and M-7000 computers, which are also supplied to Czechoslovakia.

Fig. 1.



OBR. 1

Fig. 1

Key:

a. Programmer
b. Orientation
c. Technician
d. SM-3/10 computer; 1 week
e. According to organizational capabilities
f. or
g. either
h. Mainframe
i. SM-3/10 software; 4 weeks
j. Processor and memory; 6 weeks
k. Peripherals; 6 weeks
l. Architecture and ; 2 weeks
m. Operating system*
n. 2 weeks
o. 2 weeks
p. 2 weeks

* The number of operating system alternatives is gradually being expanded.

The other branch includes the SM-2 and SM-4 minicomputers, whose model was the Digital Equipment PDP-11. The computers in this group are compatible with the Soviet M-400 computers.

Each group has one processor of lower power (SM-1P and SM-3P) and one of greater power (SM-2P, SM-4P). Processors within the same group have upward compatibility, i.e. the larger processor has all of the functional capabilities and architectural features of the smaller, while it also has additional capabilities and architectural features.

As regards the method of connecting individual devices into a computer system, the computers in the two groups differ in that:

--the SM-1 and SM-2 systems use the interface designated 2K;

--the SM-3P and SM-4P processors are connected to their peripherals by a common universal bus.

The mechanical components in both branches are standardized (e.g. in terms of the dimensions of boards, cable shelves and housings), and they have common peripherals (but different controllers) and the like. The different instruction codes used in the two branches result in two incompatible sets of software. After comparing the applications capabilities of the two series, all CEMA countries taking part in the SMEP project agreed to concentrate on developing the SM-3 and SM-4 group. This development (including software) is internationally coordinated.

Czechoslovakia is also focusing its development and production work on this series, while planning to meet its requirements for the SM-1 and SM-2 systems by import from the Soviet Union.

An overview of SMEP hardware which the individual participating countries have agreed to design as part of the joint project is given in the document "List of SMEP I Hardware." In this list, the hardware is divided into seven groups. The first group includes processors and internal memories; the second, external storage (mechanical devices and control units); the third, input-output equipment; the fourth, equipment for operator interaction with the computer (terminals); the fifth, data transmission equipment; the sixth, data preparation equipment; and the seventh, equipment for interfacing the computer with the environment.

In terms of research and development, the SMEP I stage may be considered to be essentially complete; currently the equipment is in series production.

Equipment in all seven groups on the list have been put into production in Czechoslovakia. Many SMEP hardware devices are being designed, planned for production and produced in Czechoslovakia to meet the needs of the Czechoslovak national economy. The frequently postponed beginning of series production of SMEP I computers in the SVT [?Data-Processing Equipment Plant] national enterprise in Banska Bystrice has been compensated by successive deliveries of SM-3 and SM-4 computers from the Soviet Union. Individual deliveries of the SM-1 and SM-2 systems from the Soviet union will not be considered here.

1. Import of SM-3 and SM-4 Computers from the Soviet Union

Deliveries of the SM-3/10 equipment (produced by Elektronmash, Kiev, USSR), which differs completely from the SM-1 system in terms of commercial technology (particularly as regards the prospects for Czechoslovak production of this equipment) consist of a set of hardware items and the necessary software.

In 1978, TESLA provided a set of 45 SM-3/10 systems to Czechoslovak users in the base configuration, which consists of:

--the SM-3P processor (SM-2103);

--a 32-Kbyte internal memory (SM-3101);

--an external storage unit based on the IZOT 1370 disk mechanism (SM-5400);

--a matrix printer using the DZM-180 mechanism (SM-6302);

--an alphanumeric display based on the VIDEOTON VT-340 (SM-7205);

--the SPTP-3 punched-tape I/O unit (SM-6202).

This basic configuration is considered to be a single unit, including operating technical documentation, software and the media on which it is recorded, a set of spare parts, accessories and an installation kit.

The first deliveries of the SM-3/10 were made to selected enterprises of the then TESLA VHJ, both for testing and for creation of software by the organization, which, as part of multilateral international cooperation among the CEMA countries, creates the basic and applications software and performs further research, development and production work within the SMEP system, as well as working with special applications of SMEP computers outside the scope of this international program.

Other deliveries made in 1979-1980 by Kancelarske Stroje national enterprise and Datasystem went to organizations which had brought their plans for incorporating data-processing equipment into agreement with worldwide trends sufficiently in advance, and whose organizational structure and other critical factors would allow them to make full use of the so-called "distributed intelligence" information system. The critical factor in the successful conclusion of commercial and technical discussions dealing with the purchase of SMEP systems is whether or not the individual organization contemplates introducing SMEP equipment in integrated fashion for a whole ministry, VHJ or enterprise. The extent of integration of the equipment to be introduced is also a critical factor in realizing the advantages of modular structure which SMEP equipment potentially offers. The modularity of the SMEP equipment makes it possible to introduce the so-called base configurations, which then will be gradually added to. The selection of equipment for expansion includes equipment from the base configuration (use of two or more displays and the like), magnetic tape storage, floppy disk storage, and display stations for local or remote connection.

As part of this country's import from the Soviet Union, in 1979-1980 an additional 44 of the SM-3/10 systems were delivered in the agreed-upon configuration, which had been established through studies of the interests of the Czechoslovak users and the applications in which they were to be put to use, and in accordance with the development and production capabilities of the Soviet supplier and the other suppliers of SMEP equipment within CEMA. Most of these systems were equipped with external storage subsystems using the IZOT 5003 magnetic tape store (SM-5301).

In 1980, KSNP [Kancelarske Stroje national enterprise] and DSNP [Datasystem national enterprise] began to supply imported Soviet SM-4/10 computers (produced by Elektronmash, Kiev, USSR), initially in a configuration identical with that of the SM-3/10 (two sets) and later in configurations including new types of peripherals (six sets delivered in 1980, another six in 1981).

The new types of peripherals are:

--the SM-6305 high-speed printer;

--the PK-1 casette-type magnetic tape store (SM-5208);

--the SM-5603 floppy disk store.

2. Deliberies of Domestically-Produced SM-3 and SM-4 Computers

After production got under way in 1980, the supplier organization ZAVT [Automation and Data-Processing Equipment Research and Development Base] undertook distribution of the SM-3/]0 computer (produced by ZVT Banska Bystrice) in the following base configuration:

--the SM-2301 processor;

--a 16-Kbyte (8-bit) semiconductor main memory (SM-3510);

--the DARO 1156 printer (SM-6301);

--the SM-7202 display unit;

--the SPTP3 punched-tape reader and punch (SM-6204);

--the IZOT 1370 disk-pack unit (SM-5400).

KSNP delivered 30 of the SM-3/20 computers to customers prepared for their installation, while DSNP delivered 60.

3. Basic Software Delivered with the SM-3 and SM-4 Computers

The basic software consists of a range of operating systems intended to allow the use of SM-3 and SM-4 computers in all expected fields. Thus the individual operating systems are to a certain extent applications-oriented, which means that they allow the computer system to operate effectively in a certain applications area or areas.

This orientation of the operating system (i.e., abandonment of the general-purpose operating system concept and orientation toward a specific applications area) is necessary for small computers primarily because of their small capacities (compared with larger computers). On the other hand, the specific orientation of an operating system brings benefits stemming from the most effective use of the computer system.

As in the case of the hardware of the SM-3 and SM-4 computers, the basic software is produced as part of the international cooperation between the CEMA countries. Czechoslovakia also takes part in this cooperation. A practical consequence is that specific operating systems are supplied with the computer, while others can be obtained from the national program library. A survey of the most important operating systems and their characteristics is given below.

The software of the SM-3 and SM-4 computers includes the following types of operating systems:

a. Punched-tape operating systems

--a general-purpose punched-type operating system (PLOS/SMEP), including interactive punched-tape program system (DS/SMEP, FOKAL);

--a real time punched-tape operating system (PLOS-RV).

b. Disk operating systems

--a general-purpose disk operating system (DOS/SMEP);

--a real-time disk operating system (DOS-RV) with a fixed number of priority levels, intended for controlling scientific experiments and data collection and analysis;

--a basic real-time operating system (FOBOS/SMEP);

--a real-time operating system with variable task priority and an extensive set of system functions (OS-RV);

--a dialog disk operating system (DIAMS) for collective access, intended for information-related tasks and creation of data banks;

--a disk operating system with time sharing (DOS-RVR).

The categorization of operating systems in terms of their storage media and orientation can be shown in the following table:

System orientation	System medium	
	Punched tape	Disk storage
General purpose operating system	PLOS/SMEP (DS/SMEP, FOKAL)	DOS-SMEP
Real-time operating systems	PLOS-RV	DOS-RV (and MOS-RV) FOBOS/SMEP OS-RV (and BOS-RV)
Operating systems with time sharing		DIAMS DOS-RVR

The variety of applications of the SM-3 and SM-4 is due in large part to the variety of operating system. There are operating systems which create a multiprogramming environment and operating systems intended for a single user.

The DIAMS and DOS-RVR operating systems are intended for multiuser applications. The first operates with the MUMPS language, is disk-oriented, and allows interactive parallel access to a computer by up to 40 users. The DOS-RVR uses the Macroassembler language, BASIC-Plus, FORTRAN IV-Plus and COBOL. Up to 69 jobs can be processed simultaneously, including the creation and execution of programs.

OS-RV and DOS-RV are also multiuser operating systems; they are intended primarily for applications with dynamic characteristics. Greater flexibility is achieved in the DOS-RV operating system at the cost of increased response time. The DOS-RV operating system can be modified during system generation. Both systems allow interactive and batch processing. The (B)OS-RV operates with Macroassembler, FORTRAN IV and COBOL, while the DOS-RV operates with Macroassembler and FORTRAN IV. Both of these systems allocate the processor in response to a specific event, and allocation is not generally based on a fixed-time interval.

The multiprogramming operating systems include the MOS-RV, which organizes the execution of programs generated under the DOS-RV operating system (it will be discussed in more detail below).

The LOS, DOS and FOBOS operating systems are intended for the single user. The LOS operates with Assembler, BASIC and FOKAL, DOS with Assembler and FORTRAN, and FOBOS with Macroassembler, BASIC, FOKAL and FORTRAN.

Automatic programming systems can be categorized as follows in terms of their purposes:

--the Assembler, Macroassembler, ROKAL and FORTRAN IV-Plus languages, combined with a suitable operating system, are the primary ones used in the control field. Basic, FORTRAN IV and the expanded version FORTRAN IV-Plus mentioned above are most suitable for scientific and technical computations. Besides the standard form of BASIC there is an expanded form called BASIC-Plus.

The main characteristics of these expanded forms as are as follows:

--in FORTRAN IV-Plus, arithmetical expressions may be field subscripts, and a field may have up to seven subscripts; the set of input-output commands is expanded, and bytewise and bitwise operation is possible through logical operations with numerical values;

--BASIC-Plus has commands for manipulating sets of data, allows the formulation of complex conditions, and provides functions for matrix algebra (matrix inversion, addition, multiplication and the like).

Table 1. Survey of SM-3 and SM-4 Operating Systems

PŘEHLED OPERAČNÍCH SYSTÉMŮ SM-3 A SM-4 Tabulka 1

Operační systémy 1	Systémový nositel 2	Nárok na OP 3		Programovací jazyky 4	Programový režim 5	Sdílení času 6	Dávkové zpracování 7	Určen pro uživatele 8	Ochrana souborů 9
		min.	max.						
PLOS/SMEP (soubor samostatných programů) 10	děrná páska 11	8K	28K	Assembler Basic	jedno-programový 12	ne 13	ne 13	1	ne 13
DS/SMEP	děrná páska 11	4K	28K	Fokal &	jedno-programový 12	ne 13	ne 13	1	ne 13
PLOS-RV	děrná páska 11	8K	28K	Assembler	jedno-programový 12	ne 13	ne 13	n	ne 13
DOS/SMEP	kazetový disk 14	16K	28K	Assembler Makroassembler Fortran IV	jedno-programový 12	ne 13	ano 13	n	ano 15 (ident. kód)
FOBOS/SMEP	kazetový disk pružný disk 16	16K	28K	Assembler Makroassembler Fortran IV Basic & Fokal & VU-Basic &	jedno-programový nebo dvou-programový 17	ne 13	ano 18	1	ne 13
DOS-RV (MOS-RV)	kazetový disk 14	12K	28K	Assembler Makroassembler x Fortran IV-RV x		ne 13	ne 13	n	ano 18
OS-RV (BOS-RV) *	kazetový disk 14	16K	124K	Assembler Makroassembler Fortran IV Cobol +	multi-programový (až 250 souběžných úloh) 19		ne 13	n	ano 15 (ident. kód)
DIAMS	kazetový disk 14	16K	124K	MUMPS &	multi-programový 20	ano 18	ne 13	n	ano 18
DOS-RVR	kazetový disk 14	32K	124K	Assembler BASIC-Plus & Fortran IV Cobol	multi-programový (až 69 souběžných úloh) 21	ano 18	ne 13	n	ano 18

Key: 1. Operating System
2. Medium
3. Internal memory required
4. Programming languages
5. Programming mode
6. Time-sharing?
7. Batch processing?
8. Number of users
9. File protection?
10. Set of independent programs
11. Punched tape
12. Single-program
13. No
14. Disk pack
15. Yes (identical code)
16. Disk pack, floppy disk
17. Single-program or two-program
18. Yes
19. Multiprogram (up to 250 jobs simultaneously)
20. Multiprogram
21. Multiprogram (up to 69 simultaneous jobs)

COBOL (standardized form) is intended for economic applications. MUMPS, which was standardized in 1976, is intended for use with data banks (creation of files, updating, retrieval), but also for description of arithmetical and logical operations. In its latest forms, it is a representative simple language for data banks.

The effective introduction of the SM-3 and SM-4 minicomputers is also supported by auxiliary programs, which are used primarily for preparation and editing of source texts, generation of working programs, and the listing of jobs or data.

The main characteristics of the SM-3 and SM-4 operation are shown in Table 1. The components of the SM-3 and SM-4 software include sets of application programs which expand the capabilities of the operating system regarding the use of mathematical methods of data processing and the collection, transmission and teleprocessing of information.

The operating systems shown in Table 1 which are or eventually will be available to Czechoslovak users will include the operating systems delivered with computers, those released by Czechoslovak design organizations for user testing, and those distributed by the supplier organization (for example, the Kancelarske stroje special concern is preparing to offer in 1981 a choice of operating systems, to be generated in the required configuration, including documentation and consulting services, on the basis of separate economic contracts). The table below also provides data on some so-called "higher" operating systems which are under preparation and are expected to become available.

Table 2. Survey of deliveries of SMEP operating systems

operační systém a	dodaný jako součást výpočetního systému b				mimo dodávku počítače c	
	SM-3/10	SM-4/10	SM-3/20	SM-4/20	řešitelem d k ověření	organizací e NOTO za úhradu
(P) LOS	1978 3.	1980 3.	1980			1981
DOS a DOS/RV	1978	1980				
FOBOS-1		1981 x	1980 2.		1979	1981
OS–RV *		1980 x				
(R) DOS-RV 2 § *			1981 1 x	1981		1981
DIAMS				1981 x	1980–1	1982
DOS–RVR		1981 x			1981	1982
FOBOS–2					1982	1982–3

1. tzv. nemapovaná verze
2. VU Basic a OS-VÝUKA za zvl. úhradu zákazníka
3. včetně PLOS-RV

x v rámci volitelného programového vybavení za zvláštní úhradu zákazníkem

§ v rámci volitelného programového vybavení za zvláštní úhradu lze rozšířit o Fortran IV-Plus a Basic-Plus-2

Key:

a. Operating system
b. Delivered as part of computer system
c. Separate from delivery of computer
d. Delivered by designers for testing
e. Delivered by NOTO for fee **
1. So-called "unmapped version"
2. VU BASIC and OS-VYUCKA special payment by purchaser
3. Including PLOS-RV
x. As optional software, special payment by purchaser
§ As optional software, FORTRAN IV-Plus and BASIC Plus-2 may be added for special payment

8480
CSO: 2402/1

STATUS OF HUNGARIAN RESEARCH IN COMPUTER TECHNOLOGY

Budapest SZAMITASTECHNIKA in Hungarian No 7-8, Jul-Aug 81 pp 4, 5, 11

[Unsigned report: "Parallel Information Processing, Cell Automats, Parallel Processors, Multiprocessors; The Status of Domestic Research, III"]

[Text] In the eighth part of our series we gave space to a debate connected with domestic research and the results achieved. The debate was led by Ivan Szabo, our colleague and the editor of the series or rather the organizer of the conversation. We feel that we served a good purpose by providing a forum for the meeting, permitting the participants and those interested to get to know one another better and thus making possible productive and lasting communication and work contacts in the future.

We were happy that the initiative of our editors was evaluated positively by several participants in their contributions and by others after the end of the program. The basic question is still open: What might be done or what might be worth doing in the interest of making use of our achievements in this area? The comments confirming or detracting from the several opinions or trends are the best indication of what differences in thinking exist. We hope that in the future the opinions of those interested will confirm rather than detract from one another. (The Editors)

Fay: I think everyone would be interested in what Tamas Legendi would expect from VLSI if it could be achieved in Hungary. What size cell space would be needed for a 64 K byte sorting algorithm if there were 10,000 gates in one module?

Legendi: VLSI represents a problem but also special possibilities. In my opinion manufacture of it will not begin in Hungary in a short time.

VLSI represents a very great possibility. Its use increases by orders of magnitude the quantity of parts which can be placed in a unit area. Parallel computers could not be built before because their size would have been greater than the size which could be built. So the parallel computers already developed in theory could be considered realistically only by increasing integration. With the switch from MSI to LSI, it became possible to build parallel machines, at least in the laboratory or in small series. With another increase in element capacity within a module (VLSI) the entire system capacity can increase and we can work with a larger number of

processors, perhaps with different types of processors. VSLI brings up typical, new problems. The design considerations within one module are different, the problems of system compatibility are different, integration increases more quickly than the number of pins.

It is characteristic of many tasks, however, that the task as a whole or the higher level parts of it have less broad input-output requirements than the lower level parts of it.

As for the other part of the question, if we suppose an integration level of 10,000 gates per module then a 64 K byte sorting field would need a cell space consisting of about 1,000 modules. Let me add that within a foreseeable time period VLSI technologies will make possible a gate/module ratio greater than this by 1.5-2 orders of magnitude.

Domolki: Let me try to compare the three activities reported on, not primarily to evaluate them, but rather from the viewpoint of their relationship to what was said in Mihaly Sandory's introduction.

In all three cases there are processor elements which can be called cells, which are linked together according to some more or less fixed geometrical arrangement. They work together according to the so-called cell automat principles, thus "they communicate with their neighbors." But here one can see a very essential difference which determines much. Namely that the size of these elementary processors in the solution of the Legendi type is very small, they are "microcells" of 20-100 gates. According to Doman's idea they are much bigger, the size of a smaller microprocessor, essentially carrying out one operation. For Fay they are even larger, virtually microcomputers which can independently carry out an entire program. If we examine these conceptions only from the viewpoint of parallelism (which solution makes best use of the possibilities deriving from parallelism, which is least afflicted by limitations arising from neighboring contact), then we can say that the smaller the elementary cell, the "more parallel" its operation, that is, the more elementary circuits or gate parts which can be activated at one time; the less operation is disrupted by the fact that the information which must be transmitted from the environment is available only with certain constraints. But the larger the elementary cell, the larger the part that must operate in the traditional way (for example, the individual "more elementary" circuits within a microprocessor are obviously not organized in parallel). What is more questionable here is now much time is needed, at the price of what hardware expenditure, to acquire the small amount of information which must be acquired for so much computing activity; thus, is it worthwhile to load it into such a neighborhood pillory?

This is one side of the problem, already taken up by Sandory, and if we think now of the type of problem posed by Sandory, then what is involved is an examination from the second viewpoint of the paths mentioned by him, namely, how can speed be increased with the aid of parallelism.

The other question raised by Sandory was how to devise an architecture which can best reflect the structure of the tasks to be solved (on the one hand, from the viewpoint of having the operations and data with which we work distort as little as possible, via conversion or coding, that world which we want to model and, on the other hand,

that the connections and parallel structure of these should reflect as much as possible the parallelism naturally present in the task). In this connection I feel that the dataflow principle used and further developed by Doman is that with the aid of which we can best approach the solution of the problem from the side of architecture. But I would like to make two observations; one is that for the time being we are talking only about an approximation, we are still very far from a solution. I feel that the most essential problems of this solution are posed by the programming theory, computer science, artificial intelligence aspects of it and only after these are clarified can we really raise the question of what architecture is best suited for it. My other observation is that I think those practical compromises which exist in Doman's present model tend to take us away from this trend and bring us closer to the traditional cell trend.

If we look at Fay's thinking purely from the viewpoint of parallelism and strip off those other considerations (social, psychological and computer science theoretical) which have been mentioned here, then we find parallelism primarily in a form which means taking the machine apart every day and putting it together every evening. For part of the life of each computer, it can work entirely in parallel with others, but put them together and they work as one machine. From this viewpoint it makes no difference (when the Fay type boxes are linked together in the evening) whether they are linked as cells, or in the traditional way, or however.

Szabo: Thank you, Balint Domolki, for your summary evaluation. I think this provides a good basis for debate. So I ask for comments.

Legendi: In the case of traditional computers, efficiency is a problem which has been swept under the rug. It is customary to say, since we have had operating systems, that utilization of computers is 90-95-100 percent. This is an oblique way of saying that the large functional units--the CPU, the I/O processor--are being used to a significant degree. At the level of bit-sized storage elements or gate-level circuit elements, the utilization of traditional computers is only 10 to the minus 6 or 10 to the minus 7.

This was one of the motives for cell-processor research and I think that we wanted not only to gain speed but efficiency also, indeed primarily that. If we were to achieve a realizable system one of the limiting constraints was that we had to work with microcells. Finally, however, a much more efficient architecture came into being which made it possible to get efficiency greater by three or four orders of magnitude, that is, greater performance for the number of parts specifically used. I say that this could be done only with a microcell organization, and this coincides with the qualitative observation of Balint Domolki that progress toward the microcell gives a level of greater parallelism, and makes possible really parallel, bit parallel programming.

In connection with task structure, I feel that what was said by Sandory is rather far from what we are talking about today. There are intelligent task-specific languages and program-synthesis methods. We are dealing with architectures and are three or four levels removed from this problem. It may be that we are providing a better basis for such matters because, in a certain sense, contemporary architecture (as Tibor Vamos has said in one of his talks) is, for example, an obstacle to working out really new languages. One possible reason why new languages cannot really break through is that just any language cannot be run efficiently on this architecture. But I would like to add that at the microlevel it is precisely our

microcells which make possible an adaptation to the structure of the task in the sense that one can develop completely optional operation executing units basically via software, by loading, connecting them in the cell fields. So we load operation executing units of just the size and in just the number necessary for the task.

Vamos: I have two observations. First, I believe the world has gotten beyond the philosophizing level of saying how nice it would be to be able to operate in parallel. Today we can take a task oriented approach to the architecture question since in many respects general problem-solving ability boils down to parts complexity, and we must assemble something useful out of these parts. It is obvious that every basic type of task demands a rather special architecture. We see this in all those special machines which we are trying to produce, even at the domestic level, whether they be graphic systems, machine-tool control, or picture- or sound-processing equipment. The task is similar for a data-processing system or even a communication system. So I am sympathetic to the formulation of Tamas Legendi. He can recommend relatively optimal solutions at the given technological level for a special task. I think that this is what is essential, and not the general slogan that now, "should we process in parallel or not," because there are tasks where the parallel solution makes no sense and there are others that perhaps could not be solved differently under the real conditions. Sound processing, for example. We know that we must reach a speed domain of at least 1-10 gigaflops to be able to process continual human speech with a vocabulary of, let us say, 1,000 words.

The other thing I would like to clarify is the purpose of our conversation and our role in it. We are talking at very different levels of information on three quite different themes. On the basis of what I know and on the basis of my impressions, what the Szeged group is doing is the most mature.

At one time I started, inspired by Kalmar, with 10 years of very hard, very many published achievements and failures, building on one another. And there were very hard debates in professional circles, differences in view as a result of which there is now a more settled approach.

I do not know the work of Andras Doman in much detail, but what he said and what I now quickly understand (perhaps quite poorly) fits in nicely with that international thinking in regard to dataflow solutions. This has a rather solid and well thought out mathematical and theoretical foundation which has been subjected to professional criticism. The whole thing is closer to the linguistic level and, for this reason and because of everything, its maturity level is farther along in a certain sense.

This is not a criticism, but a status statement, in comparison to where the Szeged group stands. Since this is a profound professional problem it is difficult to comment on the smallest details of it. But it is obvious that it is worthwhile to deal with this interesting trend.

The work of the third group is a little--at least to me--nebulous. I received a sort of prospectus 2 days ago and I could not tell if they were talking about a manufactured device or if it was a preliminary informational report. It said that one could get a book containing further details, but one feels a certain antipathy toward such things. In a word, I do not think this conception has been really thought out. About a decade ago, in connection with earlier theoretical work of Fay's group--which they published in various places--I recommended that it would be good to take it to an international scientific forum. In our small domestic

provincial circles it is much less possible to deal with a sphere of problems which is generally fashionable and which has been worked out over a very long time. But at the level of international scientific forums you have people who have been dealing with the problem for a long time, in a professional manner, with mathematical precision. Such critical intellectual work should be taken from the domestic arena to respected and competitive forums. It is there that we can learn the most and, on the basis of my own experience, I know that I not only sweat blood but had the most bitter experiences when I finally met readers who took a look at what we had done, pointed out its weaknesses, and frequently pointed out also that we had not paid enough attention to the work of some research groups. I say these things because the responsibility of research, of expressing opinions, must be taken very seriously and we must provide opportunities and an impulse to subject to criticism in a responsible manner those works which grow beyond normal practice. After this there suddenly appears equipment at who knows what stage of completion, with many unclarified questions. It may be that the developers are completely innocent in this, that the journalists for the daily papers made the mistake. But the question arises: What is this device in the final analysis? And an answer has not been given to this question today either.

Finally, as I have said, "very different things are on the tablecloth" here. We can contribute on the basis of very different information. So I would like to ask the respected leader of the debate: What is the purpose?

Szabo: The purpose, insofar as possible, is to pour clear water in the glass! A person wants to provide answers to unclarified questions, for the profession and for himself. If this forum can clarify questions by a certain approach, then we have provided something for professional public opinion and for ourselves. Insofar as the debate has hung up at a given level--that is how far we got.

There is also an apostolic aspect to our purpose. After we all see that different trends have met here, we should consider whether it is possible to bring them closer together--if there is some similarity in them--strengthen their harmonics and not scatter our resources.

And finally, we, the representatives of the journal, as providers of information, would like to inform and be informed.

Fay: To be informed. I am very happy to be here because I am being informed about what the others are doing and I am happy that we can exchange ideas. I have a quick, brief answer to one of the questions raised by Balint Domolki, to which Tamas Legendi also reacted. Namely, the structure of task solution. This is very exciting. Everyone tacitly takes it for granted that there is a structure to the solution of problems. The question is how to adapt to this, what architecture reflects this, and how special hardware corresponds to it. I believe that in the case of complex problems (for example, mathematical ones) we cannot really talk about the structure of task solution.

If something has never been formulated formally then it becomes a heuristic task, one must puzzle out how to solve it. (The same task can be solved in many ways, even in mathematics. One architecture may correspond to one solution and a different one to another.) In my opinion, PROLOG is a good language which can serve as a "logical enzyme" in the sense that it breaks down the task ever more simply--not in hardware but into logically manageable small units, and it tells us when something has been defined and when it has not. This is how one gets

the structure for task solution. This is why the cell automat is better (other machines are good for this too, because PROLOG is not implemented in cell automats), because it helps to disclose the solution structure for a task defined by a human being. So I say that we would be wise, for example, in the case of a verbally formulated task, if we tried to formulate, "extract" or "surgically remove" a certain structure for task solution.

Doman: I would like to add a thought to the question of Tibor Vamos about the purpose of our meeting. In my opinion, one purpose (in addition to the fact that the three themes reported on were the pretext for it) was to provide a forum for parallel computing systems, with which the whole world, including Hungary, is dealing, where those interested could exchange opinions. In this way, those interested, or who might be interested, could express their opinions about the justification for research in Hungary or about its future directions. So the purpose was to talk about the theme in a broader circle to see what might be done or what is worth doing. As I see it, in addition to hearing about these research results, we would like to discuss this more broadly--obviously many would be interested in the opinion of others.

David: In connection with the structure of problem solving I took something different from the words of Balint Domolki. If we knew the structure of problem solving, if we put it under severe constraints, it could be very harmful. If we look at a Neumann computer, all the possibilities we can realize with that computer can be seen quickly. The problem can be solved only with a program built up out of the operations of the machine. For this reason, the programming process proceeds as follows: There is a reality to be modeled and the process of programming breaks this down in a number of steps through a number of transformations into a computer program, into a model. In the first place, we use some mathematical formalism. In the second place, we extend this formalism to a certain collection of data, transformations interpreted on the data, and operations which we feel stand close to the program carried out by the computer. We call this the system plan. At the end of this process, the data have become computer data and the transformations have become machine operations--that is, the model becomes a program.

In the first place, this process is too long and, in the second place, it has a limiting factor in advance, namely, that we know what machine we are going to use. The third problem (which is also a problem of mathematics) is that in every step of the process we distort it, make compromises, so that we can run the program on the given machine. (Among other things, this also happens when we transform actions which are parallel in reality into a sequential model.) We must make this process, the process of programming, shorter, more independent of the machine and less distorted. In the ideal case, the real problem could be broken down directly into a computational medium so that the problem and the picture of it thus derived corresponded to one another.

Braun: If we look back on human culture, the world, which is parallel in many respects, is with great effort described by models, by rules worked out by many generations, which make possible the sequential solution of tasks. The difference, as compared to what has gone before, I see in the fact that now we have a tool which lacks these foundations. There is no well-known path in parallel processing,

because the ways of thinking and the tools used thus far were not developed in this direction. So not only must we now use the tool with understanding, we must also prepare a parallel interpretation of the task, which is simple if we provide a collection of cyclic runnings of our sequential algorithms, which can be made parallel, but which is not simple if what is involved is a complete reformulation of a complex task. The other big difference is that in the case of parallel computers not only does the execution of operations become parallel, so does the use of storage. Central storage ceases to exist, and just this is one of the limitations on its applicability. If one needs a large storage capacity outside of the storage within the parallel computers then the advantages can be exploited in only a limited way. There was talk about a sort machine (we heard some gigantic numbers). But this sorting capacity, if we look at it together with a magnetic disk, cannot be exploited, because the transmission speed of magnetic disks does not make this possible.

There are a few things about which I have some doubts or of which I am afraid. Both the algorithm and the uncovering of hardware faults become much more complicated and require special tools. It could cause problems that systems tested with sequential simulation will behave a little differently in reality because of their parallel character!

I feel that the need is tremendous in the field of applications. I might mention as an example a well-known technique, the finite element method. Even with their speed of millions of orders of magnitude the fast sequential processors take 10-100 hours to solve problems in nuclear technology or statics computations. The time for the solution of such tasks could be reduced to a fraction by parallel processors.

Domolki: First, in regard to the question of task-solution structure. I was talking about conforming to the structure of the task and by and large I agree with what Gabor David said about this.

But I would like to add a few things. A task (if it is a task taken from the real world) always has a natural structure. (An example which comes to mind is that this debate would have a natural structure if everybody would talk to everybody else and thus a number of parallel activities would take place simultaneously. We are forced into a certain restricted framework by the limited abilities or our "hardware" so that we can only talk one after another because for the time being the ability of the human brain and sense organs to follow several conversations at once is rather limited.) So what is always involved is that when we take a task from the real world it must always be distorted in some way because of various limitations. Every tool which we use to solve a task involves more or fewer such limitations. Gyula Fay mentioned the example of PROLOG. With the stipulation "what, but not how" it expands the possibilities, but at the same time it forces the problem into the fetters of an appropriately selected array of first-order logic. This is a much broader and harder restraint than that into which, let us say, the instruction system of an IBM 360 would force the solution of this task. And this, again, is much broader than would be problem solving on, let us say, a Turing machine. But these are "only" quantitative differences and the problem could be solved this way or that way. I see two types of things to be done here. One is, we must find tools with the aid of which we can best approach the natural structure of the tasks; and let me add, I make no

difference between hardware and software tools because after a certain level it makes no difference what sort of architecture supports the solution. Of course, not from the viewpoint of speed. And this is the second thing to be done, we must find technical solutions with the aid of which these tools can be used with the greatest efficiency, or with the least loss of efficiency. It is here that I see the difference between the two paths mentioned by Mihaly Sandory. What we should talk about here today is the second. The cell matters of the Legendi type can help link the two problem spheres primarily by providing great "emulation depth" so that by using a relatively efficient device, which can be manufactured well and programmed well, with more or less difficulty, we can realize with little loss of efficiency those higher order tools which the first trend will produce.

Legendi: I would like to speak to several themes which have been voiced. First in connection with problem solving. Some time ago we held a parallel roundtable under the leadership of Mihaly Sandory, who said then: "The task has no structure." I agree that a task, in itself, has no structure which can be attributed to it unambiguously; but with continuous decomposition in the course of task solution we usually attribute some structure to it and then it is essential with what sort of architecture this is done and we develop an architecture which will be especially suitable to service the several classes of tasks.

In connection with the comment by Peter Braun, I would like to note that although I myself am a parallelism believer it must not be forgotten that the world has both a parallel and a sequential structure and, in accordance with this, both sides must be expressed in our algorithms and computer architectures. In an article concerning the life and work of Janos Neumann, in the first volume of a work prepared for the Neumann congress, I tried to examine the problem from the viewpoint of sequentiality, and it is clear that in certain areas which can be well circumscribed the sequential machines will continue to be dominant (for structural reasons). In general the transformation of problems is parallel-sequential. The parallel-sequential approach is characteristic of problem solving in regard to human society, even in regard to work-organization methods; a typical example of this is the production-line manufacturing method in large industry. (An analog of which, to a certain extent, is pipe line and/or parallel processing.) So, looking at it from the other side, parallel processing did not appear without any antecedents and despite the sequential nature of speech and writing it would not be correct to say that the sequential mode is the only possible, correct and adequate mode for human thinking, problem solving and algorithms. We might hazard the statement that if the special boundary conditions of the task do not prescribe otherwise, then we must study the greatest parallelism which can be found in the task and must express this in our algorithms and in our architectures.

In connection with our sorting machine and also as an essential consequence of LSI and VLSI technologies, I would like to point out that since electronic background stores will soon force out the disks, in the near future it will be possible to use the sorting machine even though it is still too fast (it was made with an outmoded technology but it has a speed of 5 M records per second independent of record length), indeed it will be possible to use it ever more efficiently and, in general, we must get ready to design and build central units capable of processing a data flow of 100 M bytes to 10 G bytes. Cell processors represent one alternative for the creation of such machines.

In connection with the question of homogeneity, I believe it is obvious--not only for manufacturing technologists--how important homogeneity is from the viewpoint of preventing failures in the manufacture of equipment and parts, in design and diagnostics and in the course of operation. The microcell approach not only results in homogeneity within the chips, which shortens the designing phase for parts manufacture, but also ensures other advantages mentioned above. Concerning the value of simulation results, we can say that their applicability is restricted. We are carrying out functional simulation which ensures that if someone builds a cell field then it will be programmable, the cell programs tested on the simulator will be operational on it. Naturally this must be tested with other and special methods, for example, with highly detailed simulation or by building a hardware model, to see how such a machine must be built. Finally, going beyond simulation, there was mention of verification, which can provide a guarantee of the correctness of our cell programs--if not absolute--much more reliable than testing. Our verification system implemented in PROLOG, already partly operational, using a symbolic simulation method which can be applied only in a limited way on sequential programs ensures that the bit parallel microcell algorithms satisfy task solution written in a global specific language.

Gantner: I am afraid that you have again succeeded in finding a theme which seems to support the idea--greatly simplifying things and anticipating the question--that we have shining research results but shortsighted industry is not inclined to make use of them. Let us try to win industry over (perhaps in some democratic forum) or perhaps we should dictate to it somehow--and at one blow solve our problems connected with innovation, efficiency and recognition of our scientific achievements. This would be an oversimplified and dangerous position because it would distract attention from real (unfortunately much more complex) problems and demoralize your scientific, technical colleagues, perhaps artificially opposing them to each other instead of closing ranks.

Do not misunderstand me, I see a great future for parallel information processing (although I arbitrarily expand the concept a bit, not limiting in in space, including especially, for example, the parallel operation of units in local networks which have computing power).

We turn great attention to every scientific-technical achievement which could aid the carrying out of Videoton's developmental tasks in the years ahead, including those which may have only scientific interest for us but which increase the technical culture of our workers. (Obviously there are very many of these and we can use only some of them).

So the question is turned around for us, it is not that there is a scientific achievement and what can it be used for, rather we have a number of serious user needs and technical problems. Is there a domestic or foreign scientific achievement which might help solve these problems? And this is a very great difference! This may mean that we have shining research results and shining innovative enterprises, but the results and the needs never get together. From the national economic viewpoint (and, in the final analysis, from the institutional, enterprise viewpoint) there is input, we have good organizations, but the output, which can be measured in products, is minimal.

The theme of our roundtable talk today is an example. As I have said, I think we are talking about very interesting things which have a future. But for us the question now is (and obviously this follows from the unique perspective mentioned above) will the achievements born here help in the domestic "socialization" of computer technology, will they provide a solution to the problems of office mechanization, cheap and efficient processing, data management for small and medium enterprises--to mention only the most important domestic problems, and not in the order of their importance. If so, will they fit into the domestic structure and are they the most efficient for us? If not, then could they be interesting from another viewpoint, is it worthwhile to spend energy on their cultivation, and how much?

It has been shown in innumerable cases that the critical R and D personnel and expenditures (including getting something into production) cannot be guaranteed in our homeland for most themes, that in so-called following or preparatory research less energy, by an order of magnitude, would suffice.

Someone mentioned the atom bomb. Well, I think there is no need to prove that neither Jeno Wigner nor Leo Szilard nor anyone else could have made one in Hungary; it would have been in vain to demand it from researchers and industry.

I think that the discovery and exploitation of fundamentally new principles cannot be the most important task of Hungarian technical life today. One cannot overcome the 5-10 year lag which can be measured in productivity and technical level (if it can be measured at all) with an economy of this size (or with larger ones, as well-known examples show) with great leaps by concentrating on the tip of the iceberg.

We must pay attention to the tip of the iceberg, but we must turn much greater energy to the underwater part (the part that ultimately determines the potential of a country) which, perhaps, is invisible from the "bird's eye view of science." So the question is not, should we deal with this theme, but rather who should do so and with what energy (expenditure). And this is the decision that is hard to make, but which cannot be avoided. Research trends which cannot be used directly today may be very important (indeed, it is these that usually bring new results) and one must not expect immediate industrial products from them. I am convinced that this decision cannot be made on democratic foundations. It can be prepared this way, but those who guide research must decide (that is what they are getting paid for) and they must assume responsibility for the decision.

And we must measure over the longer run what achievements (not piles of paper and "never again seen" exhibit models) are born in each area (profession or organization). Then we must draw the appropriate conclusions and if necessary.... If "personalities" are important anywhere then I think they certainly are in the guidance of research.

Finally, even if from the industry side we do not see or hope for the immediate utility of cell automats, there can be a responsible decision that they should be cultivated by the people X with the expenditures Y, because over the long run the energy and knowledge thus used will bring greater profit than if we turned it to solving the most important operational economic problems of today. And this decision must be made not by industry and not by professional society but rather by research guidance, and later they must be responsible for it too.

The decision need not reflect the opinion of the majority. I recall that it was a Hungarian mathematician who proved that in general joint decisions made entirely democratically are not the optimal ones. But later we must reckon with the decisions of today.

To sum up I might say that research on the problem of cell automats is not the most important problem for Videoton today, but we have faith that there will be a professional decision which will be in harmony with the importance of the role played by this theme in the national economy later. And if it is true that Hungarian scientific life is 5-10 years ahead of industrial development then it may not be so difficult to decide.

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HUNGARIAN EXPERIENCE WITH SM-4 COMPUTER

Budapest SZAMITASTECHNIKA in Hungarian No 7-8, Jul-Aug 81 p 7

[Article by Lajos Ivanyos: "Experiences With the SM-4 Computers"]

[Text] In the fall of last year, readers could learn in the columns of this journal that the Automatic Works of the Measuring Instruments Factory (MMG AM) was among the first domestic purchasers of the Soviet-made SM-4 computers. Last year, in honor of 7 November, Soviet installation experts but the first SM-4 configuration in operation at the MMG AM in a very short time (a total of 6 working days).

The time which has elapsed is sufficiently long for us to report on the first operational experiences to those interested in the development of the MSZR [minicomputer system] program. Since the MMG AM wants to use the machines of the MSZR series primarily for process-control tasks the first experiences were the subject of a recent lecture organized by the Electronic Computers and Control Equipment Section of the Measurement Technology and Automation Scientific Association (MATE).

At the request of the editors, I am publishing in written form an abridged version of what was said in my lecture.

The MMG Automatic Works, which has valuable traditions and experience in connection with development, design, manufacture, installation and operation of process instrumentation and process-control systems, has undertaken a significant role in the petroleum and natural gas supply program of the CEMA countries in the areas mentioned above.

The development of a modern product and systems structure required numerous experiments, transfer of licenses and know-how and acquisition of imported equipment. In the preceding plan period, significant support in this was provided by the KGM [Ministry of Metallurgy and the Machine Industry] and the OMFB [National Technical Development Committee] (program-controlled machines, computer-programming systems, a precision foundry, a computerized materials-testing laboratory, process-control program packages and developmental system, etc.). Among the obligations assumed in connect with this support was that the MMG AM had to study the questions of the applicability of minicomputers which could be obtained in the socialist relationship and, insofar as possible, adapt the process control program packages for them.

At present, the computer park of the MMG AM consists of two ES 1010's, one PDP 11/34, and PDP 11/04, two TPA 1140's and two SM-4's.

The PDP 11/34 computer, which was installed in the first half of 1979 in connection with the purchase of process-control and machine-tool-programming program oackages (and which serves the development of process-control systems, machine-tool-control programs and programs which can be used in other areas of the production activity of the enterprise), justified the broad applicability of members of the PDP 11 series with storage capacity greater than 32 K words and of minicomputers compatible with them. It became possible to do tests in connection with the fitting of cassette disks and matrix printers obtained from the socialist camp to the PDP 11 computer and, vice versa, the testing of the TPA 1140 put into operation during 1979-1980 and the SM-4 computer mentioned in the introduction with an original DEC operating system. Since the TPA 1140 and the Soviet-made SM-4 correspond to the PDP 11/40 and not to the PDP 11/34 which has a floating decimal processor, we generated RSX systems for testing at the compatible software level. Beginning in November 1980 an RSX system was also used on the SM-4 machine for the MMG AM's own developmental work; this is a fundamental condition for using program systems purchased under a license.

The tests showed software compatibility in regard to operating systems, program languages and applications-oriented program packages.

At the hardware level, compatibility between the PDP, TPA and SM machines was not provided at the module level due to the differing development of the system units and module connections. But bus-level compatibility makes possible an exchange of functional units between the various types with minimal transformational work. So the results of the compatibility tests are unambiguously positive in regard to the PDP 11, TPA 1140 and SM-4 machines.

The common characteristics of the SM-4 series computers, the Soviet one now tested and the Czechoslovak, Bulgarian, etc. versions which may come later, are:

--bus-level hardware compatibility;

--software compatibility, including the usability of RSX 11 operating systems;

--a broad supply of quality software;

--storage which can be expanded to 124 K words (248 k bytes);

--environmental (climate) operating conditions which are not strict; and

--cheapness.

The MMG AM is doing the following program development work on the SM-4 computers:

--process-control centers (delivering a telemechanical system to the Soviet Union in 1981, delivering a system to guide a gas-compressor station to the Soviet Union in 1982, etc.);

—technical and data-processing applications within the enterprise (FORTRAN, BASIC) and data preparation; and

--program development for the SM-4 and for mini and microcomputers using the INTEL 8085 processor.

Figure 1 shows a typical SM-4 configuration in process-control systems of the MMG AM. The hatched units do not figure in the Soviet delivery. In the first applications, these parts were supplemented by hardware-software adaptation of SAM 85 modules developed and manufactured by the MMG AM (peripheral expansion unit, semiconductor storage expansion unit). Finding sequential, asynchronous adaptation units missing from the Soviet deliveries is a key question for applications within the MMG AM (remote terminals, higher level computer links, process terminals, a quasigraphic display, etc.).

In addition to the solution mentioned (based on the SAM 85 modules manufactured in series), we have begun development of a more generally usable solution with which we can exploit the bus-level hardware compatibility of computers delivered by various manufacturers. We also developed a system unit made exclusively of parts which the MMG AM also uses for other purposes and so has always on hand. The sequential adaptation, etc. cards manufactured in the MMG AM can be plugged into this.

In this way, it becomes possible to supplement the missing units which are difficult to acquire or which can be acquired only at too high a price not only in the case of the SM-4 but also for our PDP 11 machine. Figure 2 shows the structure of our SM-4 configuration which has been in operation since the end of November 1980.

An independently operating small machine can also be assembled from the spare units of the two SM-4 systems ordered from the NOTO OSZV [NOTO National Computer Technology Enterprise]. The computer technology people of the MMG AM installed this basic configuration (16 K words of storage), put together and tested in Budapest, in the Kecskemet factory unit of the enterprise in March 1981, and they put it into operation without outside help.

Putting the second, larger SM-4 system into operation was completed on 1 June 1981, after about 1.5 months of work, by people from the Kiev factory. The extra work here was represented by the installation of three casette disk units, additional storage modules and three magnetic tape units (for example, the magnetic tape control unit and the cards in it arrived with a noticeable mechanical deformation).

After running factory tests, we tested the configuration with an RSX 11 operating system generated on our PDP 11/34. The signing of the delivery protocol took place on 3 June after 2 days of testing and the configuration was put into use.

We expect displays, floppy disk and storage units as further expansions for our SM-4 machines and in the future we ourselves will make the sequential adaptation units.

Finally, our experiences acquired with the configuration in operation since November:

Failures--

--there were shipping deformations;

--we found contact soldering problems on a number of circuit cards in the first months (such failures did not appear after repairing them);

--failures were caused by rigid cables breaking off from connectors of cables moved (if possible the drawers should not be moved in and out);

--connectors shook loose, especially cable connectors and the NYAK connectors securing the cables;

--disks hung up primarily because those putting the unit into operation sometimes forgot final tightening of the stop screws; and

--power-unit failures (the permeable transistor in the storage power unit and the rectifier bridge diode in the disk power unit).

(Note: In the more than 6 months prior to the day of the lecture we had to stop for the last two reasons in the list on an average of 8 hours of daily operation. Regular weekly maintenance eliminated the previously mentioned failures.)

Sensitivity--

--lasting network voltage drops resulted in unreliable operation (according to the specifications, the guaranteed range was 220 Volts plus 10 percent or minus 15 percent). Unfortunately we recently have often had network voltages under 187 Volts!

--the effect of quickly repeated brief network outages coincides with what was said above. According to our experience this is a frequent phenomenon between 1530 hours and 1800 hours at the MMG AM, No 41 Szepvolgyi ut, District III!

--heating of the cassette disk unit; about half an hour after switching on the cassette disks heat up significantly;

Disks written on when warm cannot be read without error in the "cold" state and disks written on when cold cannot be read without error in the "warm" state!

--environmental temperature; lasting operation at an environmental temperature above 30 degrees Celsius can cause unreliability in a number of essential circuit units and can cause lasting irregularities (power units and storage blocks).

Maintenance requirements--

--daily clearning of mechanical peripherals (reader, punch, DZM-180) and checking and adjustment weekly;

--checking cable connectors at least weekly;

Figure 1.

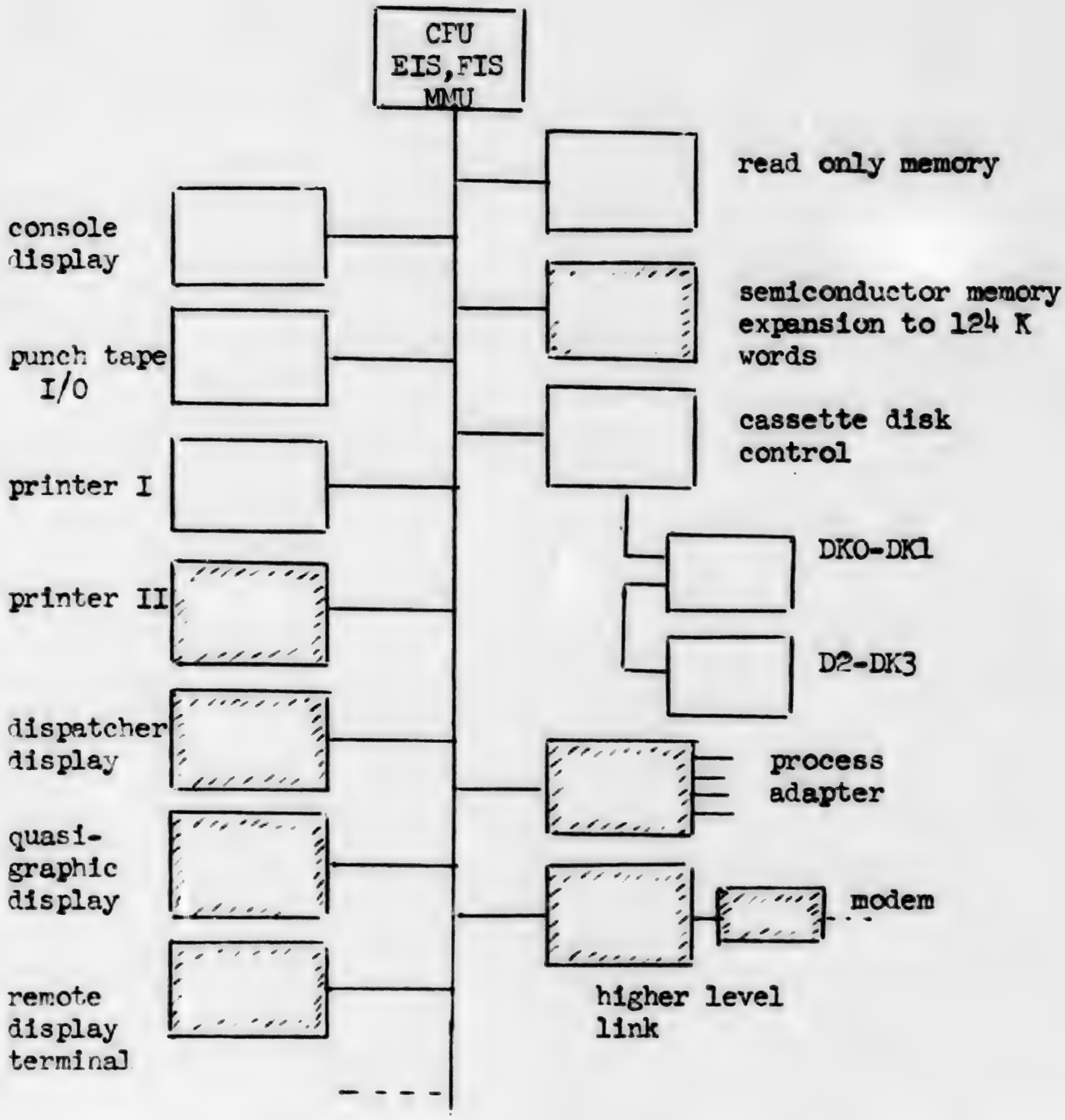
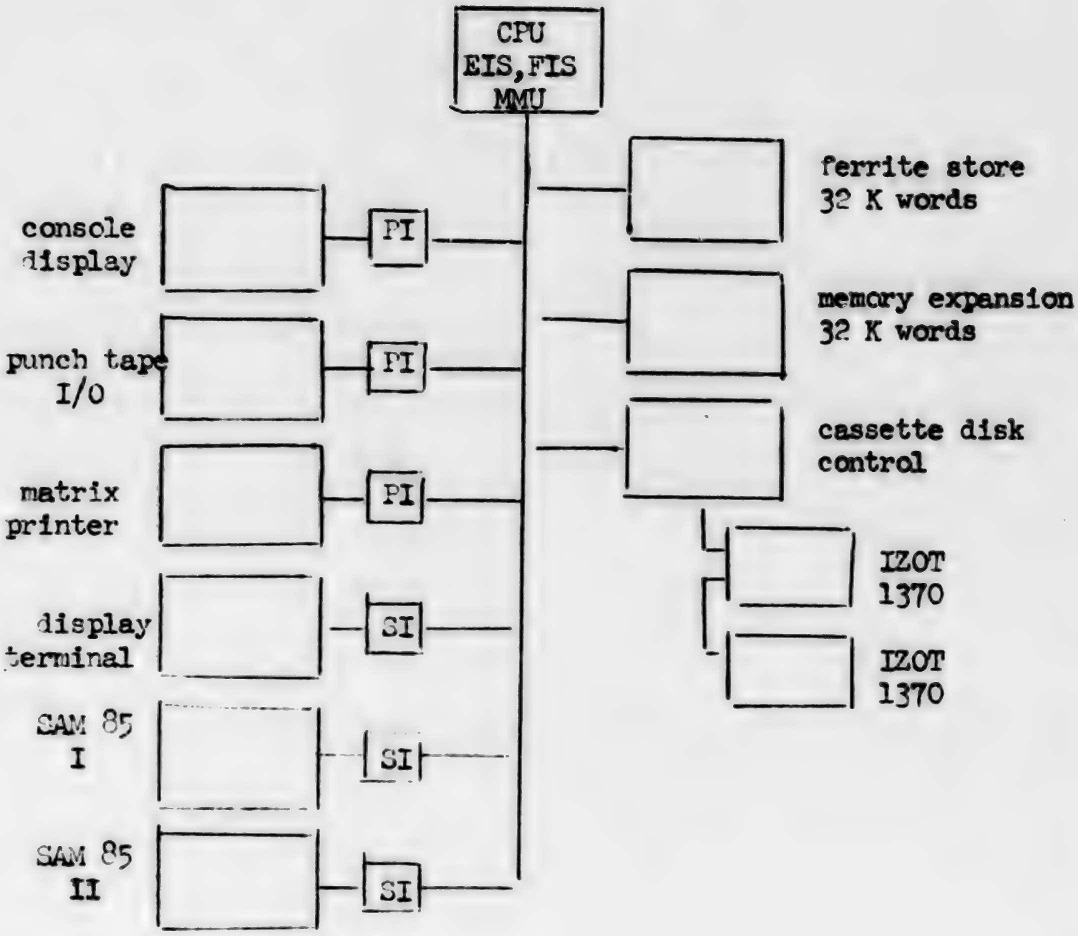

CPU
EIS,FIS
MMU
read only memory
console
display
semiconductor memory
expansion to 124 K
words
punch tape
I/O
cassette disk
control
printer I
DKO-DK1
printer II
D2-DK3
dispatcher
display
process
adapter
quasi-
graphic
display
modem
remote
display
terminal
higher level
link

Figure 2.



EIS -- expanded instruction set

FIS -- floating decimal instruction set

MMU -- Memory Management Unit

DK0, DK1, DK2, DK3 -- disks

PI and SI -- parallel and serial interface

--in the event of failure, one should think first of connector failures, then contact soldering failures and finally failure of parts.

In conclusion, I want to tank Szilard Vadasz, a department chief in the NOTO OSZV, who in several questions supplemented what I said with the following useful information.

--it is not good to move the circuit cards in and out because the gold-plating of the NYAK connectors gets worn off!

--over-heating of the cassette disks can be avoided if you take off the back panel, which stops the flow of air;

--the hanging up of the disks can be avoided if the OSZV experts tighten the screws sufficiently during maintenance, so the operators should not have to deal with this failure phenomenon.

The questions asked after the lecture pertained to compatible machines manufactured in the socialist countries, to the parts base for these, prices in comparison to the price of machines made domestically, etc.

I think that the answers given to the questions and those experiences about which I spoke gave a reassuring picture of the fact that the MSZR program of the CEMA countries has really begun and has fulfilled those hopes which the minicomputer experts attached to the appearance on the domestic market of the SM-4 machine category.

8984
CSO: 2502/26

VT 20 COMPUTER EVALUATED

Budapest SZAMITASTECHNIKA in Hungarian No 7-8, Jul-Aug 81 pp 8, 9

[Article by Tamas Fodor: "The VT 20 And Its Applications"]

[Text] The program of the Alba Regia Days held in May every 3-4 years since 1964 always counts as an outstanding event in the life of Szekesfehervar. This tradition looking back over a few years is dwarfed by the thousand-year history of Szekesfehervar but it increasingly reflects the achievements of the city through social, political, economic, cultural, health affairs and sport programs.

Comparison With Videoton General Purpose Computers

	VT 20	ES 1010M	ES 1011	SM-52
Operational store (K bytes)	64	128	1,024	1,024
Disk (M bytes)	5-10	10-20	100-200	100-200
Number of magnetic tapes	—	4	8	8
Performance of line printer (lines/s)	300	600-1,200	600-1,200	600-1,200
Number of terminals	4	16	32	32
Time to add one word (microseconds)	4	1.75	1.75	0.6
Operating system	time segment	multitask	multifunction	multifunction ES 1011/PDT 11 operating mode
Prices (millions forints)	1-2	5-10	10-20	

Scientific conferences are not missing from these programs. The Fejer Megye organization of the NJSZT [Janos Neumann Society of Computer Technology] regularly contributes a conference to the program of the Alba Regia Days. Most recently, in 1978, the Computer Technology Factory of Videoton introduced its newly developed products, those which it is manufacturing and marketing in the present five-year plan. We have selected the VT 20 business computer which figured in the conference titled "The VT 20 And Its Applications" held on May 6 and 7 this time. According to experience thus far, this is arousing very great interest. As Dr Zoltan Marton, chairman of the Fejer Megye organization of the NJSZT, and I pointed out the VT 20 has an extraordinarily favorable price/performance ratio and is a computer developed for office and business applications of which 200 will be marketed this year.

Development of the computer began in 1978 and zero series manufacture took place in 1979. The entire system (hardware and software) was developed in Szekesfehervar.

On the first day, participants could become acquainted with the architecture and operating system of the VT 20. Laszlo Csapo, developmental engineer for Videoton's Computer Technology Factory, presented a block diagram of the system, the available peripherals and the technical characteristics (figure) and talked about plans for further development. Three speakers described the operating system--Karoly Csoti (monitor, data file management, system programs and utilities) and Csaba Tolvaj (index sequential data file management) are developmental engineer for Videoton's Computer Technology Factory and Tamas Tiszai (BASIC) is a programmer at the Kalman Kando Electrical Industry Technical College.

The chief services of the monitor, which makes possible the running of several tasks (a minimum of 5) independent of one another, are the following:

--loading and starting programs;

--modifying, transferring and recovering memory content;

--displaying memory content on the console screen;

--adapting logical peripherals to the physical peripherals;

--stopping at a given address;

--putting in break points;

--executing a program by cycle or by step;

--modifying registers;

--initiating and scheduling tasks.

It must be noted, however, that the monitor does not take care of resource management. Coordinating and distributing resources among tasks is the task of the programmer. The task of sequential data file management is management of the library on disk--source and object programs or assigning and storing sequential information as desired--and dynamic allocation of disk areas. The disk is broken down into basic units consisting of 16 secotrs and a data file is created by chaining basic units. The chained basic units are placed on various regions of the disk. It keeps track of occupied and free basic units. It ensures the opening, writing, reading and closing of data files.

The speaker reported briefly on the initializing, data file copying and library maintenance programs which belong to the systems programs. The library maintenance program makes possible recognition of the library catalog, the erasing of data files which have become superfluous and the modification of data files.

Assembler programs are created by an assembler translator and an edit-correct program which records and corrects source language programs and compiles source programs. The macroassembler can generate a relocatable and absolute format object program. The loader recognizes both formats. The utilities complete the operating system. The disk content modifying program ensures the display on the screen by sector of information stored on disk, and modification thereof. In the course of character chain search in memory or on disk, the program seeks in the given address content and displays together with the address the reference string. There is also a possibility for modification of it.

With the aid of a comparison program in the course of a byte by byte comparison of object programs on disk and in memory, differences can be listed on the screen or on the printer. In addition to the above, the object program which can be placed in memory can be saved on disk. Good aid in the solution of data-processing problems is provided by the DABAS, the system's index sequential data file manager.

The subroutine collection makes possible creation, modification and access according to keys of a data base of a given organization. The DABAS itself performs organization of the disk, the user does not have to deal with this. Keeping track of data records on the disk takes place according to keys. The keys can be 39 characters long. A collection of a maximum of 16 keys can belong to one collection of data records. The individual collections of keys are always ordered, and are ordered hierarchically in several levels. As a result of this system of ordering, any data record can be reached with five disk accesses.

The characteristics of the BASIC translation program for the VT 20 are very favorable (it takes up 16.5 K bytes). Its arithmetic and mathematical function library make it suitable for technical scientific calculations and its character chain management, its compatibility with the sequential data file manager and its index sequential data file manager make it suitable for solving data-processing tasks. It has the further advantage that assembler-level routines can easily be built into the BASIC programs.

On the basis of a commission from Videoton, the Mathematics and Computer Technology Institute of the Kalman Kando Electrical Industry Technical College ran a test on the BASIC. In the course of this they used a bench mark program on the basis of which the KFMI [Central Physics Research Institute] has measured the program running time of a number of systems used in Hungary. (The program can be found on page 14 of the September 1977 issue of COMPUTER.) We find these data below, supplemented with the running time of the VT 20:

The surprise of the first day of the conference was a report on and demonstration of a television information system. A VT 20 computer with a modulator on the central cable antenna system of Szekesfehervar--the best in the country and managed by the real estate management enterprise--broadcast a detailed program for the conference. Although the information system operated only for the 2 days of the conference, it well illustrated the limits of the application of the VT 20 computer.

Processor	System Version	Running Time
8080 micro P	LLL	90.0
ICC (8080)	ELTE-KFKI	27.0
TPA-i	Teasys MU (1 felh.)	141.0
TPA-1140	8K PT	3.7
ES 1010	IDOS	81.5
PDP-11/40	ES 1011	5.0
Tektronix 4051 (6800)	version shipped with system	40.0
PET home-computer (6502)	Microsoft	28.0
VT 20	version shipped with system	29.0

Margit Varga, program designer for the Computer Technology Experimental Plant Deposit Association, gave a talk on a floppy disk data recorder developed for the VT 20. The data-preparation system uses a format language to accelerate data recording and perform an efficient formal and logical check of the documents. With programs written in this very simple format language, the user can check the correctness of the documents (limits, arithmetic and logical operations, analysis of links between fields, comparison with lists, etc.). The format language makes possible automatic filling in of permanent fields on certain documents, the prescription of editorial instructions and programmed control of typing operations. The user can perform efficient preprocessing simultaneous with data recording thus reducing the number of information steps necessary to create an error-free data file. The data-preparation system is based on a VT 20 computer with a minimum of 40 K bytes of RAM. The background storage is an MOM [Hungarian Optical Works] MF 3200 floppy disk with a usable capacity of 256 K bytes but an IZOT 1370 disk of 5 M bytes can be used instead. The floppy disks serve the archiving of recorded data or pass it on for further processing. A write mode corresponding to the IBM 3740 makes it possible for the disks to be accepted by other computers in addition to the ES 1010M and the ES 1011.

Data are input with a special data-recording keyboard which has a separate numeric field. A screen displays the data. The screen is capable of displaying 24 lines of 80 characters each. The configuration becomes complete when supplemented with a printer.

The first step in executing any recording task is the writing and translating of a format program corresponding to the given document type. The writing of the format programs and the translation take place in the interactive mode. The translated format programs can be archived on floppy disk. After a valid sign-on procedure it is possible to initiate a format program developed for the document type to be recorded. The data go from screen to floppy disk under control of the format program. Following the first typing of any data packet, one can turn to

retyping for purposes of verification. Repeated input for purposes of comparison is necessary only for faulty fields designated in the format program. Correction of errors deriving from a bad filling in of the document, which were left in deliberately or by chance, and erasing or inserting what has become necessary in the meantime can be done according to the rules and possibilities of a separate correction procedure. Lists can be prepared from the data put on disk according to various viewpoints.

The speaker reported on a four-work-site version of the data-recording system, which will be put on the market by Videoton in the second half of this year.

Janos Kovacs, a department chief in the Computer Technology Factory of Videoton, then reported on a text-processing system based on the VT 20.

The VTEXT text-processing system makes possible convenient typing, storage, modification and simple reproduction of various written materials (documents, letters, reports, etc.).

Istvan Gonda, a software developer for the MEM [Ministry of Agriculture and Food] Technical Institute, reported on agricultural uses of the VT 20.

The changes which have taken place at specialized cattle sites--the development of maintenance technology and the level of production and especially the great concentration of stock--place increased requirements on leadership and guidance activity. The high concentration of stock requires programmed, even production guidance, which is also one of the ways to increase yields. Thus the use of computer technology and automated methods is appearing in the large-scale technology of cattle sites around the world. The MEM Technical Institute has prepared such a system on a commission from Videoton.

The services provided by the system are the following:

--forecasting certain technological events, from birth to first calving in the case of calf and heifer stocks and to next calving in the case of cow stocks;

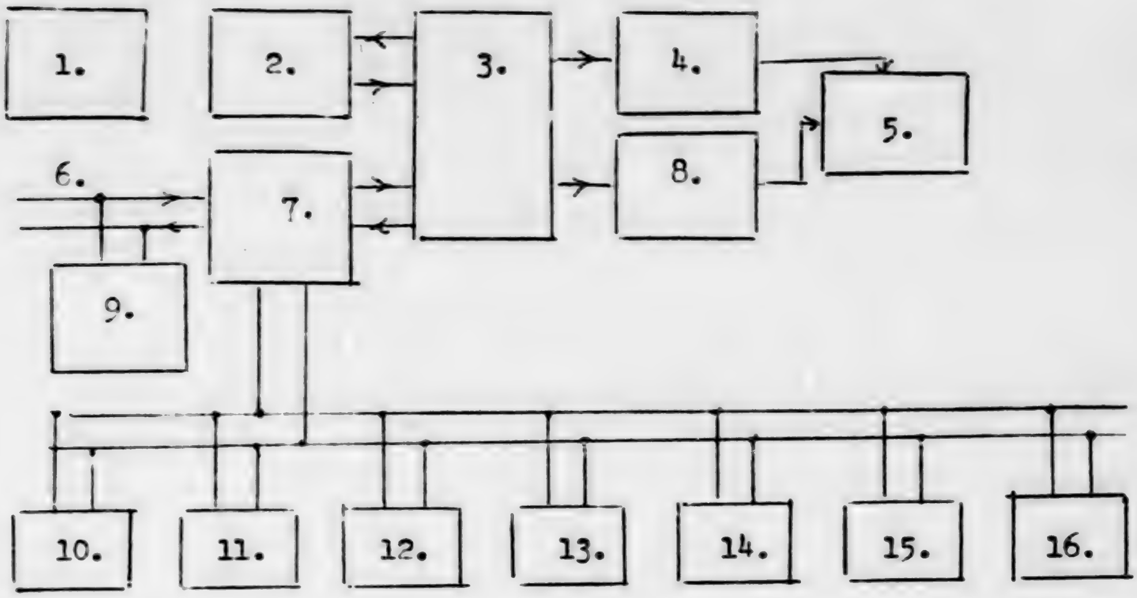
--subsequent checking of technological events and rescheduling of events missed;

--following production data. Taking weight measurement data as a base, one follows the daily or monthly growth of calves and heifers. By recording monthly milk-production data of cow stocks one can forecast milk production, deriving functions for finished lactations and calculating an index for balanced milk production (persistence);

--establishing a feeding system based on production data, developing an optimal ratio of bulk and seed fodders;

--preparing veterinary decisions and aiding medical work by processing health data;

--preparing records for the sites as a whole which show the distribution of the stock according to various "technological states" or production parameters; and



1. Power unit; plus or minus 5 V, plus or minus 12 V, plus 120 V
2. Display store; 4,000 characters; two direction scroll
3. Display logic; line or field organization; fields--normal, intensive, flashing, underlined, protected
4. Deflection
5. Screen--25 lines x 80 characters
6. Storage bar
7. Microprocessor--2 microsecond cycle time; 78 instructions; 8 IT control; RT clock
8. Video amplifier
9. CPU store; 64 K bytes--16 K ROM, 48 K RAM
10. Keyboard connection; Latin or Latin plus Cyrillic keyboard--standard typewriter arrangement, numeric field, automatic repeat, sound signal
11. Printer connection; DZM 180, B 300, VT 80 column or VT 132 column
12. Punch tape read and punch connection; TTL level, BSI interface, DT 105S, CT 2000
13. Floppy disk connection; MF 3200 MOM disk (1-4 units)
14. Disk connection; IZOT 1370, 5 M bytes (1-4 units)
15. Four-line group control; 4 single current duplex lines (asynchronous), 1-4 VSD simple displays
16. Data transmission unit; synchronous/asynchronous CCITT V 24 j. f. v. 20 mA current loop (max. speed 9,600 bit/sec)

—preparing statistical indexes aiding a planned elimination of stock.

Finally Dr Janos Mezei, a physician at the Fejer Megye Hospital, and Gabor Berkovich, a software developer for the Computer Technology Factory of Videoton, reported on health applications of the system.

A computerized records system for the blood transfusion station of the megye hospital was implemented as the first step of a computer technology program for the hospital, as one module of an integrated hospital data-management system. The basic task of the system is to keep computer records on the donors of the blood transfusion station, making possible quick selection of donors with the desired blood group. Another task is to prepare ad hoc and cumulative statistics on blood donations, selecting those entitled to recognition on the basis of the number of donations and providing more and more detailed information to the local Red Cross organization for its work in preparing for blood donations.

A speech by Laszlo Szlomka closed the conference. The chief of the commercial main department of the factory reported on prices and units manufactured, already mentioned, and turned to the service activity of the factory and the development thereof. In addition to the already existing customer service units in Budapest and Szekesfehervar, regional centers will be established this year in Miskolc, Szeged and Pecs and in 1982 in Debrecen and Szombathely. In addition to performing guaranteed repairs, they will have the task of hardware and software maintenance on the basis of contract, providing background machines, giving advice and preparing contracts and user software.

The conference was held in one of the architectural prides of Szekesfehervar, the House of Technology. A special VT 20 operated in the corridor beside the conference hall. The organizers—who came from the enthusiastic collective of developers—showed that programs and messages typed in or appearing on the console of the VT 20 could appear on eight television screens placed in the conference hall to help the speakers. During the recesses and after the talks, the developers provided detailed information on the VT 20 for those who wanted to get more detail on the system.

The hopes of the organizers were fulfilled. The great interest in the VT 20 was shown by the fact that the 250-seat conference hall was completely filled and a number of guests "took their place" on the steps.

8984
CSO: 2502/26

DEVELOPMENT, REQUIREMENTS OF COMPUTER INDUSTRY ASSESSED

Warsaw INFORMATYKA in Polish No 9-10, Sep-Oct 81 pp 4-7

[Article: "An Assessment of the Polish Computer Industry During the 1971-1980 Period and how this Industry Is Satisfying the Needs of Information Science"]

[Text] This report, requested by the Ministry of Science, Higher Education and Technology and the Ministry of Metallurgy and Machine Industry, was prepared during April and May 1981 by a team chaired by Prof Antoni Kilinski which included Doc M. Bazewicz, Doc Z. Bzymek, Prof A. Grzywak, Dr J. Gwiazda, Mgr Eng A. Musielak, Doc H. Orlowski, Prof S. Paszkowski, Dr W. Staniszkis, Prof W. M. Turski, Prof S. Wegrzyn, Mgr A. Ziaja and invited representatives of the Ministry of National Defense. In accordance with the orders of the ministries, the report assesses the development of the computer industry in Poland during the 1971-1980 period and the extent to which this industry had satisfied the needs of information science in Poland. A separate section of the report describes the development of the K-202 minicomputer.

At the start of the 1971-1980 decade, institutionalized efforts were intensified toward the comprehensive control of information science problems in Poland. These efforts, despite the often extreme importance placed on the accepted form of organization, were for the most part irrational because in the area of most importance--the development of useful information science applications--they did not go beyond pompous declarations.

Formally, in point of fact, the following were involved in turn with information science affairs:
The Plenipotentiary of the Government for Matters of Electronic Computer Equipment [PRETO], operating during the 1964-1971 period;
The National Office of Information Science [KBI], operating during the 1971-1975 period;
The Committee for Information Science, operating from 1975 to the present and, up to 1980, directed by the premier of the government;
The Government-Party Commission, operating during the 1973-1974 period.

The first two institutions (PRETO and KBI) had no influence--not even formally--on the activities of the computer industry. The Committee for Information Science was

solely a propaganda institution devoid of executive power, and the Government-Party Commission involved itself primarily with personnel matters and produced nothing more than general declarations.

Whatever the chances were for the comprehensive treatment of information science problems, they were decisively squandered when the information science tasks were divided among different ministries. An expression of such a division was Decision No 3 of 11 January 1974 of the Presidium of the Government which assigned responsibility for:

--the production of computer hardware and basic software to the Ministry of the Metallurgy and Machine Industry;
--the production of utility software to the Ministry of Sceince, Higher Education and Technology;
--the production of operating material to the Ministry of Chemical Industry and the Ministry of Forestry and Timber Industry;
--the production of data communications equipment and the development of a computerized-information network to the Ministry of Communications.

With such a division, no state organ was factually responsible for the proper development of applications which, according to the official doctrine, were supposed to be a derivative activity of the production ministries which, in turn, were guided by their own economic indices. The separation of software production from hardware production was a characteristic feature of the above division of tasks. As a result, in Poland during the 1976-1980 period, basic economic activity in the realm of information science did not occur in general, that is the delivery of computerized-information systems consisting of hardware and their own software.

Because it was not in the forefront of any important auxiliary activities (soliciting and consultation), the computer industry was completely devoid of natural incentives for development that fashioned similar industries in the world (not only in the Western countries but also in the Eastern countries, for example, the GDR), it did not develop as designated, that is, as the result of two forms: technical progress and customer requirements; instead its development was determined by economic indices that were more or less arbitrarily established.

In addition to the conceptual shortcomings of the state's information science policy, other shortcomings occurred during the 1971-1980 period that evolved from the general disorders of our economic structure.
--The parochialism of the ministries. The ministries, branches and enterprises having greater "breakthrough force" obtained at times very significant resources to create computer centers in their central offices. Unfortunately, the higher schools are subordinate to ministries having a small "breakthrough force" and, as a result, the higher schools are equipped with information science equipment which is much worse than that in the central offices and central associations, which is a curiosity on a world scale. Similarly, such activities as health protection, social service on a mass scale, education and so forth also had a small "breakthrough force."

--The ostentatiousness of information science applications. Many completely good computer systems were installed for prestige reasons without proper preparations and without honest analyses of suitability. These systems, which lacked source data

and had software that was not adapted to Polish realities, served primarily to demonstrate modernity and as objects to boast about before guests.

--The nonimplementation of accepted economic programs. This was especially detrimental to the development of the computer industry. For example, by Decision No 3/74 of the Presidium of the Government, 11 billion zlotys were approved for the computer industry, but of this amount barely 3.5 billion zlotys were received by the computer industry during the 1971-1980 period; the projected production of magnetic data carriers was never initiated; and programs for the production of electonic components are systematically delayed and unrealized with regard to assortment and quality.

Since 1975, information science applications in Poland have been consciously delayed by categorizing hardware as capital goods. Since that time the number of installed domestic and imported computers has decreased.

The phenomenon of a decreasing number of new computer installations is not happening and has not happened in any other country in the world. The imposition of high accumulative allowances on the computer industry (yielding only to the accumulative allowances on alcohol distillers) has created a unique situation in Poland in which the state places a high de facto tax on information science users. In most countries tax abatements are favored instead.

Research and Development Facilities

Information science is an activity that especially requires systematic preparations of scientific, training and technical facilities.

Since the start of the 1970s, the principle regarding the lead-time development of facilities and cadres relative to economic activity (production and applications) in the area of information science has not been properly heeded. This is one of the primary reasons why many applications have failed and why hardware purchased from the capitalist countries has not been used efficiently.

The inadequate or old computer equipment of the higher schools and the inadequate development of industrial research-development facilities were serious mistakes of that era. Quantitatively, such MERA [Automation and Measuring Apparatus Industry Association] facilities employed, together with employees of the Experimental Centers, 3,150 people in 1971, compared to 4,500 in 1975 and 3,260 in 1980. Many employees involved in production or customer service were considered to be OBR [Research and Development Center] personnel and even as employees of some institutions. As a result, technological research and technical equipment development were almost completely suspended, relying on the import of licenses for prepared technological equipment. In contrast to our policy, the other CEMA countries, especially the GDR and Bulgaria, increased their facility employees several times over during this period.

In general, it can be stated that there were insufficient numbers of information science scientific-research and scientific-training facilities in relation to projected production goals and applications.

The Computer Industry

During the 1971-1980 period, the major portion of Poland's computer industry was grouped within MERA, which is subordinate to the MPM [Ministry of Metallurgy and Machinery Industry]. However, the role of UNITRA [Electronics and Telecommunications Industry Union], the primary supplier of components for the computer industry within the MPM, should be remembered.

As a result of implementing the information science policy, Poland's computer industry did not satisfy most of the country's needs, even in the "better" years 1971-1975. Then again, its existence was threatened during the 1976-1980 period. In defending itself against this threat, the computer industry assumed a notably proexport strategy for development and production. During the 1976-1980 period, domestic deliveries of Polish computer hardware was limited to about 20 percent of the value of this industry's production. Production based only on a level of established limits for domestic deliveries was not economically justified.

The ratio between exports and domestic deliveries deteriorated year after year and was the reason for the progressive isolation of Poland's computer industry from the problem of information science applications in Poland. At the same time, this industry was treated more and more as a subsection having to finance the nation's balance of international payments.

Limitations on investments, employment and coproduction deliveries brought about the nonfulfillment of projected production capacities, the nonapplication of planned technologies, and the underdevelopment of scientific-research facilities and service.

The mentioned reduction of employment in MERA's scientific-research facilities and the samll and limited production of computers made it impossible for this industry to make real progress in production and, in many cases, making it unprofitable to implement technological changes and impossible to develop in a reasonable time frame many required programmer tools and configuration extensions.

During the 1976-1980 period, the computer industry did not obtain deliveries of the electronic large-scale-integration (LSI) subassemblies, including semiconductor memories and microprocessors, that were agreed to during the 1973-1975 period (and taking into account when the licenses were purchased). Polish electronic subassemblies used in Polish-produced hardware are an indication of the level of its modernity and reliability and are decidedly worse compared with modern hardware based on LSI subassemblies. MERA products based on LSI subassemblies, for example, the MERA 100, MERA 200, LX 2010, LX 2020, LX 2500, NUCON 400 and other microcomputers, were in general not available to domestic users or were available only on a small scale because they used subassemblies imported from the II payments area [capitalist countries] and were intended for export to the II payments area or for Polish consumers as a return on their foreign-exchange input.

In effect, the industry adapted a proexport mode of operation developed during the 1976-1980 period which was based on the large-scale production of peripheral equipment primarily for export within the framework of Poland's specialization within CEMA. The export of information science equipment was the most profitable export of the electromachinery industry during the 1971-1975 period, during the 1976-1980

period whole computer configurations were not exported on a large scale because during this period all CEMA countries were beginning to produce their own systems, satisfying the needs of their own domestic users; they permitted supplementary imports into their markets only in special cases. Poland's computer industry took advantage of these special cases and exported several systems each year during the 1976-1980 period.

The licenses applied and purchased during the 1972-1976 period initiated the production of several new products, for example, mosaic printers, printer-based terminals, cathode ray tube (CRT) monitors, floppy disk memories, systems to collect and initially process data, and a microcomputer system to control machine tools and multioperation machine tools. Nonetheless the limitation of dliveries to domestic users and the fact that it was necessary to import electronic subassemblies in conjunction with these new licenses meant that Polish users did not receive this equipment in sufficient numbers to satisfy their needs.

The post-license development of these products during the 1981-1985 period will permit the production of modern microprocessor-controlled printers, a whole family of CRT monitors, double density floppy disks and specialized microprocessor-controlled terminals.

It must be admitted that the licenses purchased by the computer industry were successful. They are generating significant benefits, for example, character-mosaic printers and floppy disk memories.

Poland's cooperation with the socialist countries, realized within the framework of MKETO [International Commission for Matters of Electronic Computer Equipment], initiated the specialization of production and, at the same time, extended the production series and lowered equipment manufacturing costs. Specialization enables production to be concentrated in several selected assortment groups and, at the same time, computer configurations to be prepared in accordance with user requirements owing to the import of other assortments purchased with foreign-exchange funds earned from exports. This potential benefit of cooperation was not utilized because the Planning Commission limited foreign-exchange allotments for imports from the capitalist countries during the 1976-1980 period. The granted annual foreign-exchange allotments were not sufficient to import equipment to complete the systems equipped with Polish processors (for example, there was a lack of Bulgarian disks, GDR card readers and the like).

The lack of a modern subassembly base, expecially during the 1976-1980 period, and the lack of high quality components during the entire decade produced two negative results:

--high-cost hardware;
--relatively low quality of computer systems compared with those produced by the leading capitalist countries in this field.

As a result the following occurred:

--users intensely solicited allotments to purchase foreign hardware when those same foreign-exchanges funds, if used to purchase subassemblies for the computer industry,

would have provided a greater number of good equipment for Poland (such as occurred with the MERA 9150, a device produced partially with the purchasers' foreign-exchange funds);

--the computer industry started producing hardware for applications in real-time systems, especially for process-control systems, only to the extent to which it could count on subassembly imports from the capitalist countries. It realized that the quality of hardware produced from Polish components would not be adequate. It should be emphasized that the comparison of Polish products with products from the II payments area is negative with respect to cost and quality, but when compared with products from the other CEMA countries the products of our industry are decisively better.

Despite the mentioned limitations that resulted from the computer industry's realized proexport policy, the industry did expand production during the 1971-1980 period as shown by the figures presented in the tables and charts below.

Table 1.

Table 1

	Produkcja globalna (sztuk)	1971	1976	1980
2	komputerów	56	105	70
3	mini- i mikrokomputerów	0	390	352
4	urządzeń zewnętrznych	1675	[illegible]	19187

Key:

1. Total production (units)
2. Computers
3. Minicomputers and microcomputers
4. Peripheral equipment

Table 2.

Table 2

	Produkcja na kraj (sztuk)	1871	1875	1880
2	komputerów	32	97	49
3	mini- i mikrokomputerów	0	345	296
4	urządzeń zewnętrznych	1139	3065	6247

Key:

1. Production for domestic use (units)
2. Computers
3. Minicomputers and microcomputers
4. Peripheral equipment

Figure 1.

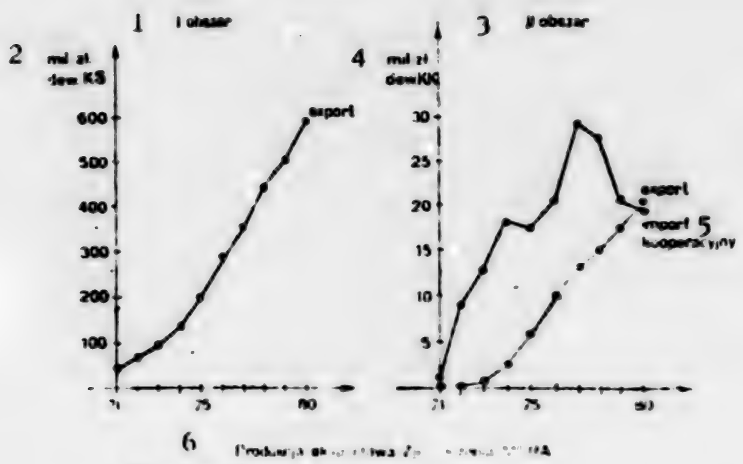


Figure 1

Key:

1. I payments area (socialist countries)
2. Millions of foreign-exchange zlotys of the socialist countries
3. II payments area (capitalist countries)
4. Millions of foreign-exchange zlotys of the capitalist countries
5. Coproduction exports
6. MERA's export production

The significant preponderance of coproduction imports from the II payments area over exports to this area during the 1971-1980 period resulted in part from the application of licenses but mainly from UNITRA's delayed production of subassemblies. In 1980 a favorable balance was achieved in the settlement of accounts with the II payments area.

Despite the generally difficult conditions of the generally unsatisfactory deliveries to domestic users, the computer industry realized specific product [goods and services] achievements during the 1971-1080 period, for example it:

--expanded MERA-ELWRO's production capacity to a volume of 300 computers annually;
--developed and produced a series of ferrite operating memories for JS i SM EMC [Uniform System and Minicomputer System of Electronic Digital Computers];
--developed and initiated production of the MERA 60 minicomputer;
--developed a MERA 60 flotation-process-control system and a MERA 80 microprocessor-controlled system for textile machines;
--developed a system based on the MERA 400 to control personnel movements in the Siersza mine;
--developed the SAD and SWINTET data-base systems for JS EMC computers;
--developed the MERA 400 minicomputer;
--developed the SOM-5 operating system;
--developed and initiated production of tape memories;
--developed a number of automation and measurement systems provided to users as so-called turnkey deliveries, for example, to the Labeda mill, to MERA-ELZAB and to the Medical Academy in Katowice.

The Computer Industry and Satisfying Poland's Information Science Needs

In accordance with centrally adopted resolutions, the computer industry was responsible for hardware and basic software deliveries and computer services. It was rationally assumed that a country of Poland's size could not produce the full assortment of hardware required by information science, and thus specialization and exchange within the CEMA framework were implemented. The appropriate resolutions assuring Poland's information science needs were passed at the MKETO forum. Unfortunately the results of the computer industries of the countries associated with MKETO were worse than the results of our own computer industry regarding scheduled production of new products, their prices and, in many cases, their quality. It was espcially unfavorable for large capacity disk memories and computer graphics equipment.

As a result of this and the fact that the limitations on independent purchases of equipment from individual CEMA countries were obligatory in Poland, it was not possible to complete systems, including real-time systems, according to user needs.

During the 1976-1980 period, the Planning Commission started limiting computer hardware deliveries to domestic users as capital-goods deliveries. The limitation was twofold: the total sum of the deliveries was calculated in zlotys, and the nominal distribution list of computer customers was confirmed by the Planning Commission each year. This meant that MERA, in working out a directive type distribution list of computers for domestic users, had to include in it the amount of deliveries for a given year, and in effect the lack of correlation between the amount of deliveries and the number of users brought about configuration deliveries that did not meet user needs. For these same reasons it also was not possible to expand previously delivered configuration in accordance with user needs.

Customers who had a choice either to purchase framework configurations or in general to depend on the Planning Commission's distribution list chose the former. As a result the number of computers installed in Poland that were counted as "units" increased, but the increase in computation capability was disproportionately small in relation to the incurred outlays.

It should be noted that the configurations supplied by the computer industry were unsuitable not only with regard to utility system requirements but also with regard to software requirements and capabilities.

The investment restraints on the computer industry during the 1976-1980 period held the technical base of service to its 1975 level, which caused the already unsatisfactory service to decrease significantly even as the number of installed user hardware increased. The quality of the administered component base, the continuing shortage of subassemblies and the applied technologies, despite the notable efforts of the computer industry (mainly ELWRO) to improve hardware reliability, produced imperceptible results as far as the users were concerned.

Software

In Decision No 3 of the Presidium of the Government, which was mentioned in the introduction, the computer industry was unjustifiably excluded from software production activities. Also, the obligatory system of economic indices was an

effective counterstimulus for such activities. Because the report concerns only the computer industry, only basic software is discussed in the section below.

The software of the world's major computer companies is not completely compatible with Polish hardware; the development of programs by individual computer centers was not undertaken on a national scale in an organized way and, as a result, an organized exchange of programs among computer centers did not take place. The development of programs in an unorganized way by some computer centers outside the computer industry does not change the factual state of affairs.

Production of ODRA 1300 and R-32 computers meant that computer producers did not have to develop completely new basic software on their own. Software for the ODRA 1300 was appropriated from the ICL 1900 computers and for the R-32 from the IBM 360/370 computers of the socialist countries. The computer industry operating in the then current economic conditions (which recognized only the production of hardware as directly productive work and work on software as a sideline work) severely limited work on software. Meanwhile, in exploiting the compatibiliity of our hardware with the hardware of the major world firms, after the suitable software was accepted when production was initiated, we should have worked on our own software. This expecially concerns the R-32 computers. As is well known, IBM's software for the 360 and 370 computers has many advantages, but it also has one basic shortcoming, that is, for efficient operation it requires additional hardware, expecially large operating memories. Meanwhile, the hardware configurations delivered to users by the Polish computer industry or that were imported were very modest owing to material shortages. Thus they operated much less effectively with the IBM-adapted software than they could have operated with basic software developed in Poland, on which a very limited amount of work was done.

In its attempt to fill in the gap in the minicomputer market caused by the fact that K-202 minicomputers were not serially produced, MERA 300 minicomputers were sold before adequate software was prepared for them. Before the computer industry or the users could generate this software, the MERA 300 turned out to be so obsolete that its production was justifiably discontinued.

In the basic software for the MERA 400, compatibility among operating systems was not such that existing software could operate with the newer, better operating systems. As a result, the large collection of library programs and the translators developed for the SOM-3 operating systems cannot be used with the more efficient SOM-5 and CROOK operating systems.

Conclusions

Computer applications are an essential and strategic element of a rationally functioning national economy. They are necessary to provide information services to the people, to control technological processes, to assist management, and as aids for defense tasks, scientific research, training and so forth. Most technological equipment must be equipped in the near future with microprocessor-based controls.

--Above all, existing computer and minicomputer configurations must be supplemented with such hardware and software so as to assure better service and supplies of spare parts, even at the cost of discontinuing the production of new computer installation over the next several years.

--Special emphasis should be placed on minicomputer and microcomputer applications because outlays for these applications are lower and implementation times are shorter.

--The modernized JS and SM EMC equipment and microcomputers should be the preferred lines for further development of computer systems in Poland. This is in accord with economic prerequisites, CEMA resolutions and the immense experience gathered in Poland by original system users and by industry. We should develop our own software for this family of computers, making optimum use of our hardware's capabilities and the current state of the art in the world.

--To effectively use the potential of the ODRA 1300 systems now in Poland, it is necessary to guarantee its users parts and equipment to operate with optimal configurations.

--Inasmuch as the computer industry is one of the most efficient industries in the world (it uses very little energy and raw materials but requires much brain power), it should be expanded in Poland, becoming one of the export specialties.

--The export of computer services, software and specialized turnkey computerized-information systems are the most profitable; thus far this export has not kept pace with Poland's potential and it should be intensified.

--The computer industry's export specialization should not be at the expense of domestic user needs.

--Guaranteed access to modern LSI and very large-scale integrated (VLSI) electronic components and subassemblies is a necessary condition to expand the computer industry's production and to assure the proper reliability of its products.

--Adequate research facilities, deliveries of spare parts and a well organized and equipped training base for users as well as service personnel are necessary conditions for successful domestic applications and export of computer systems.

--The excessive and unjustified accumulations imposed on computer hardware and services are a deterrent to the expansion of the rational application and production of computer hardware.

--New and modern computer hardware should be installed in all the higher schools with sufficient lead-time to guarantee that the new generation of workers in the economy will know how to build information systems effectively and how to take advantage of them, and also to guarantee the investigation and expansion of applications of newly produced products.

--To avoid in the future the shortcomings that afflicted Polish information science and the computer industry during the 1971-1980 period, the following procedural principles must be observed.

--Acknowledged resources must be adequate to meet designated goals or else the goals must be changed. The principles that "somehow it will work" and "shift for yourself" cause waste and nonachievement of goals.

--From the point of view of social needs and use of completed investments, the functionality of delivered systems is what is important, not the amount of produced "iron." The limitation on the employment of customer service personnel, designers and programmers by the computer industry to benefit workers producing material and energy is also harmful.

--The number of installed computer configurations is not important; what is important is their reliability and completeness relative to user needs and utilized software (the creation of optimal configurations is not of any concern here).

--The economic mechanisms must also be worked out so that coproduction for a producer of finished products (for export) would be more profitable for the component producer than the direct sale of these components. Otherwise the production of systems for export, which is especially profitable, will not expand.

--Committed assignments must be complied with completely, especially those concerning economic organizations. An example of an intolerable situation is when the MPM accepted the proposal concerning MERA's purchase of a license which involved the coordination of supplies from UNITRA which subsequently changed UNITRA's plans.

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11 Dec 1982